CLAIMS

Having described the invention that which is claimed is:

1. An article of manufacture containing a first chemical composition useful to treat a second chemical composition dissolved in an aqueous liquid in contact with the exterior surface of said article:

said article is a capsule comprised of a hollow interior, said first chemical composition enclosed in said hollow interior, and a membrane, permeable to said aqueous liquid, which maintains said first chemical composition in said hollow interior;

said membrane is comprised of at least a first material, a polyurethane-vinyl polymer dispersion prepared by the simultaneous polymerization of a vinyl monomer and chain extension of an isocyanate-terminated polyurethane prepolymer in the presence of water, which is not reactive with, soluble in or a solvent for said first chemical composition, said second chemical composition or said aqueous liquid in contact with said exterior surface of said capsule; and

said first chemical composition is reactive with said second chemical composition, is soluble in said aqueous liquid in contact with said exterior surface of said capsule, is not reactive with, soluble in or a solvent for said first material; and is selected from, enzymes, and organic and inorganic acids, bases, salts and oxidizing agents.

2. The capsule of claim 1 wherein said first chemical composition is selected from the group consisting of medicines, pesticides, algaecides, herbicides, cosmetics, laundry products, pigments, polymerization initiators, cross linking agents, viscosity reducing agents and additives for adjusting the setting properties of hydraulic cement.

3. The capsule of claim 1 wherein said first chemical composition is a solid, water-soluble chemical composition having a particle size in the range of from about 10 to about 60 mesh US Sieve series.

4. The capsule of claim 1 wherein said first material is cross linked with agents selected from polyaziridines, carbodiimides, epoxies and metal ion cross linkers.

5. The capsule of claim 1 wherein said first chemical composition is selected from alkali and alkaline earth metal halides, oxides, hydroxides, carbonates, bicarbonates, perborates, peroxides, percarbonates, bisulfates and persulfates.

6. A method for controlling the introduction of a first chemical composition into reactive contact with a second chemical composition comprising:

introducing into an environment comprised of at least one aqueous liquid having said second chemical composition dissolved therein, a capsule comprised of a hollow interior, said first chemical composition enclosed in said hollow interior, and a membrane, permeable to said aqueous liquid, which maintains said first chemical composition in said hollow interior, whereby the exterior surface of said membrane is in contact with said aqueous liquid;

permitting said aqueous liquid to permeate said membrane to contact said first chemical composition enclosed in said hollow interior to produce a solution of said first chemical composition in said aqueous liquid; and

permitting said solution to permeate said membrane to contact said aqueous liquid in contact with said exterior surface of said membrane to thereby place said first chemical composition into reactive contact with said second chemical composition; wherein

said membrane is comprised of at least a first material, a polyurethane-vinyl polymer dispersion prepared by the simultaneous polymerization of a vinyl monomer and chain extension of an isocyanate-terminated polyurethane prepolymer in the presence of water, which is not reactive with, soluble in or a solvent for said first chemical composition, said second chemical composition or said aqueous liquid in contact with said exterior surface of said capsule; and

said first chemical composition is reactive with said second chemical composition, is soluble in said aqueous liquid in contact with said exterior surface of said capsule, is not reactive with, soluble in or a solvent for said first material, and is selected from enzymes, and organic and inorganic acids, bases, salts and oxidizing agents.

7. An article of manufacture containing a first chemical composition useful to treat a second chemical composition dissolved in an aqueous liquid in contact with the exterior surface of said article:

said article is a capsule comprised of a hollow interior, said first chemical composition enclosed in said hollow interior, and a membrane, permeable to said aqueous liquid, which maintains said first chemical composition in said hollow interior;

said membrane is a composite material comprised of a first material and a second material wherein said first material is a supporting matrix for said second material which is fixed in said supporting matrix;

said first material is a polyurethane-vinyl polymer dispersion prepared by the simultaneous polymerization of a vinyl monomer and chain extension of an isocyanate-terminated polyurethane prepolymer in the presence of water, and said first material is not reactive with, soluble in or a solvent for said first chemical composition, said second chemical composition, said second material, or said aqueous liquid in contact with said exterior surface of said capsule;

said second material is different from said first material, is a particulate, and is not reactive with, soluble in or a solvent for said first chemical composition, said second chemical composition, said first material, or said aqueous liquid in contact with said exterior surface of said capsule;

said first chemical composition is reactive with said second chemical composition, is soluble in said aqueous liquid in contact with said exterior surface of said capsule, is not

reactive with, soluble in or a solvent for said first material or said second material, and is selected from enzymes, and organic and inorganic acids, bases, salts and oxidizing agents.

8. The capsule of claim 7 wherein said second material in the composite material is a particulate solid having a particle size in the range of from about 1 to about 15 microns present in the composite material in an amount in the range of from greater than about 0 to about 50 percent particulate solid by total weight of composite material.

9. The capsule of claim 7 wherein said second material is selected from silica, calcium carbonate, titanium dioxide, barium sulfate, calcium sulfate and mixtures thereof.

10. The capsule of claim 7 wherein said first chemical composition is selected from alkali, alkaline earth metal and ammonium halides, oxides, hydroxides, carbonates, bicarbonates, perborates, peroxides, percarbonates, bisulfates, borates and persulfates.

11. The capsule of claim 7 wherein said first material is reacted with cross linking agents selected from polyaziridines, carbodiimides, epoxies and metal ion cross linkers.

12. The capsule of claim 11 wherein said cross linking agent is admixed with said first material and said second material in an amount in the range of from about 1 to about 5 per cent cross linking agent by weight of said first material.

13. The capsule of claim 7 wherein said composite material is present in said capsule in an amount in the range of from about 10 to about 50 percent of said composite material by weight of said capsule.

14. The capsule of claim 7 further comprising a third material deposited on said composite material as an overcoat.

15. A method for controlling the introduction of a first chemical composition into reactive contact with a second chemical composition comprising:

introducing into an environment comprised of at least one aqueous liquid having said second chemical composition dissolved therein, a capsule comprised of a hollow interior, said

first chemical composition enclosed in said hollow interior, and a membrane, permeable to said aqueous liquid, which maintains said first chemical composition in said hollow interior, whereby the exterior surface of said membrane is in contact with said aqueous liquid;

permitting said aqueous liquid to permeate said membrane to contact said first chemical composition enclosed in said hollow interior to produce a solution of said first chemical composition in said aqueous liquid; and

permitting said solution to permeate said membrane to contact said aqueous liquid in contact with said exterior surface of said membrane to thereby place said first chemical composition into reactive contact with said second chemical composition; wherein

said membrane is a composite material comprised of a first material and a second material wherein said first material is a supporting matrix for said second material which is fixed in said supporting matrix;

said first material is a polyurethane-vinyl polymer dispersion prepared by the simultaneous polymerization of a vinyl monomer and chain extension of an isocyanate-terminated polyurethane prepolymer in the presence of water, and said first material is not reactive with, soluble in or a solvent for said first chemical composition, said second chemical composition, said second material, or said aqueous liquid in contact with said exterior surface of said capsule;

said second material is different from said first material, is a particulate, and is not reactive with, soluble in or a solvent for said first chemical composition, said second chemical composition, said first material, or said aqueous liquid in contact with said exterior surface of said capsule; and

said first chemical composition is reactive with said second chemical composition, is soluble in said aqueous liquid in contact with said exterior surface of said capsule, is not

reactive with, soluble in or a solvent for said first material or said second material, and is selected from, enzymes, and organic and inorganic acids, bases, salts and oxidizing agents.

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